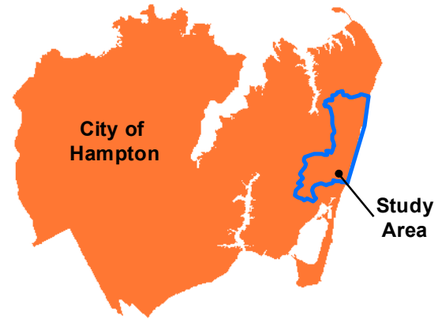
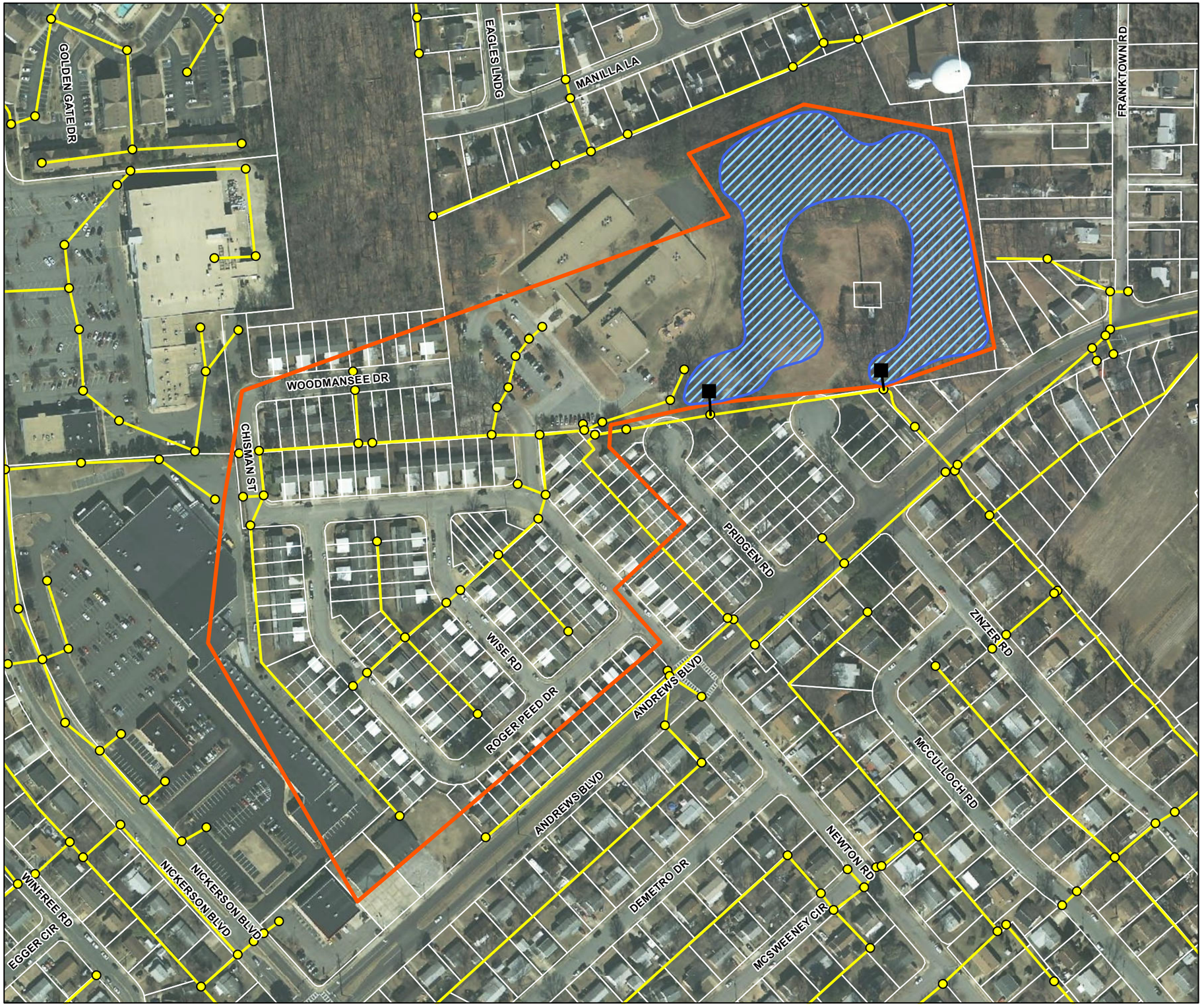
Appendix A — Figures

Buckroe Beach & Riley's Way Watershed Management Plan



Concept Stormwater Plan

Merrimack Elementary School Constructed Wetland



Legend

- Existing Stormwater Inlet
- Existing Stormwater Pipe
- Proposed Stormwater Structure
- Proposed Stormwater Pipe
- BMP Drainage Area
- Proposed Constructed Wetland

0 100 200 400

1 inch = 200 feet

N W E S

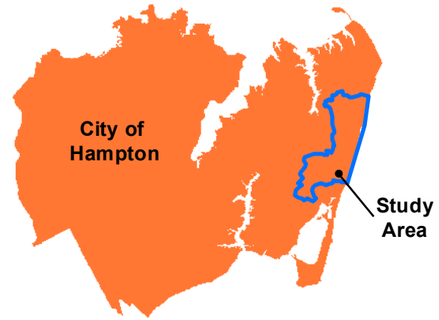
Prepared for:

CITY OF HAMPTON JULY 9, 1610

Prepared by:

Kimley-Horn and Associates, Inc.

Buckroe Beach & Riley's Way Watershed Management Plan



Concept Stormwater Plan

Jones Magnet School Bioretention Area

Legend

- Existing Stormwater Inlet
- Existing Stormwater Pipe
- Proposed Stormwater Structure
- Proposed Stormwater Pipe
- BMP Drainage Area
- Proposed Bioretention Area

0 100 200 400

1 inch = 200 feet

N W E S

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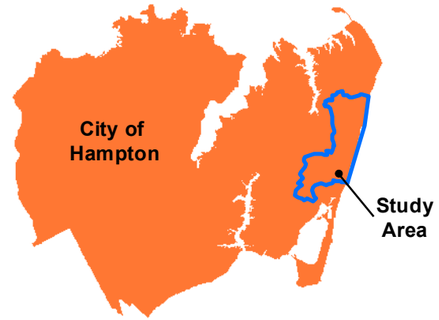
Buckroe Beach & Riley's Way Watershed Management Plan



Concept Stormwater Plan

Buckroe Shopping Mall Constructed Wetland

Legend

- Existing Stormwater Inlet
- Existing Stormwater Pipe
- Proposed Stormwater Structure
- Proposed Stormwater Pipe
- Proposed BMP Drainage Area
- Proposed Constructed Wetland

0 150 300 600

1 inch = 300 feet

N W E S

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Prepared by:

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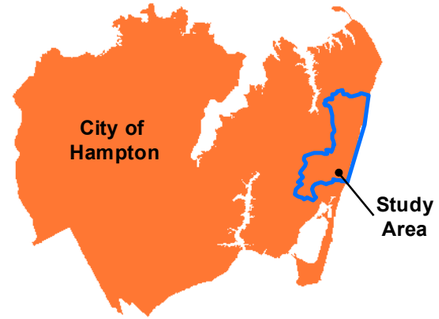
Buckroe Beach & Riley's Way Watershed Management Plan



Concept Stormwater Plan

Buckroe Avenue Redevelopment Constructed Wetland

Legend

- Existing Stormwater Inlet
- Existing Stormwater Pipe
- Proposed Stormwater Structure
- Proposed Stormwater Pipe
- BMP Drainage Area
- Proposed Constructed Wetland

0 100 200 400

1 inch = 200 feet

N W E S

Prepared for:

CITY OF HAMPTON JULY 9, 1610

Prepared by:

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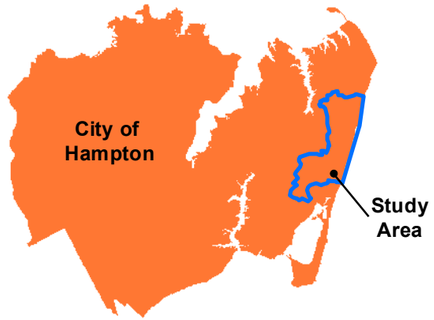
Buckroe Beach & Riley's Way Watershed Management Plan



Concept Stormwater Plan

Amherst Road Constructed Wetland

Legend

- Existing Stormwater Inlet
- Existing Stormwater Pipe
- Proposed Stormwater Structure
- Proposed_Pipe
- Proposed BMP Drainage Area

0 250 500 1,000

1 inch = 500 feet

N W E S

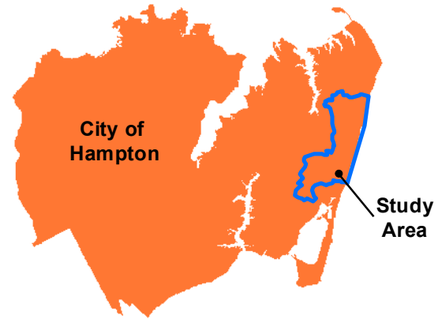
Prepared for:

CITY OF HAMPTON JULY 9, 1610

Prepared by:

Kimley-Horn and Associates, Inc.

Buckroe Beach & Riley's Way Watershed Management Plan



Concept Stormwater Plan

Fields Drive Constructed Wetland

COLONIAL ACRES DR
OLD BUCKROE RD
RHODA CT
FIELDS DR
LAFAYETTE DR
CHOWNING DR
EASTHILL CT
JAYNE LEE DR
5TH ST
ANDREWS BLVD
HUNLAC AVE
HUNLAC AVE
KYLEE LN
BARNES CT
CARMEN DR
ROGERS AVE

Legend

- Existing Stormwater Inlet
- Existing Stormwater Pipe
- Proposed Stormwater Structure
- Proposed BMP Drainage Area
- Proposed Constructed Wetland

0 100 200 400

1 inch = 200 feet

N W E S

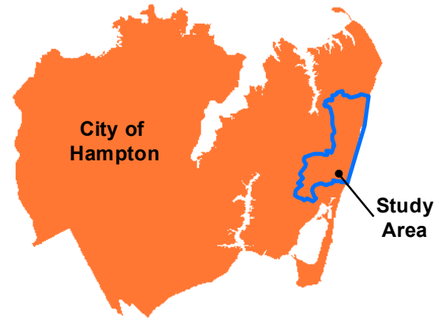
Prepared for:

CITY OF HAMPTON JULY 9, 1610

Prepared by:

Kimley-Horn and Associates, Inc.

Buckroe Beach & Riley's Way Watershed Management Plan



Concept Stormwater Plan

Hall Road
Constructed Wetland

OLDENBURG LA
HALL RD
FOX POND LA
VENTURE LA
FOX GATE WAY
BENSON DR
EASTLAWN DR
HALL RD
CARDINAL DR
ALARIC DR

Legend

- Existing Stormwater Inlet
- Existing Stormwater Pipe
- Proposed Stormwater Structure
- Proposed BMP Drainage Area
- Proposed Constructed Wetland

0 100 200 400

1 inch = 200 feet

N W E S

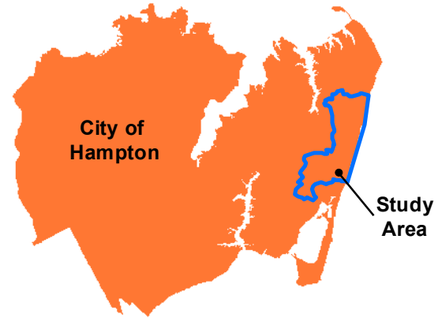
Prepared for:

CITY OF HAMPTON JULY 9, 1610

Prepared by:

Kimley-Horn and Associates, Inc.

Buckroe Beach & Riley's Way Watershed Management Plan



Concept Stormwater Plan

5th Street
Drainage Improvements

HUNLAC AVE
CARMEN DR
ROGERS AVE
BENTHALL RD
PILOT AVE
RICHMOND DR
5TH ST
4TH ST
MALLORY ST
2ND ST
6TH ST
TAPPAN AVE

Legend

- Existing Stormwater Inlet
- Existing Stormwater Pipe
- Proposed Stormwater Pipe
- Proposed Section of Raised Road
- Proposed Flood Gate

0 100 200 400
1 inch = 200 feet

N W E S

Prepared for:

CITY OF HAMPTON JULY 9, 1610

Prepared by:

Kimley-Horn and Associates, Inc.

Buckroe Beach & Riley's Way Watershed Management Plan

Concept Stormwater Plan

SWMM Model Link-Node Map

Legend

- SWMM Model Nodes
- SWMM Model Links
- Project Area

0 600 1,200 2,400

1 inch = 1,200 feet

Prepared for:

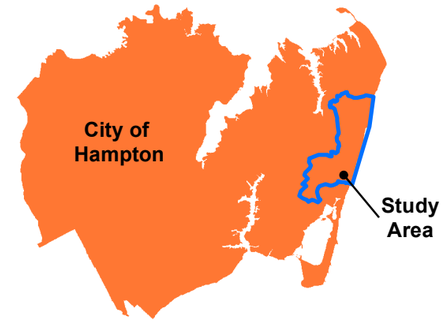
CITY OF HAMPTON JULY 9, 1610

Prepared by:

Kimley-Horn and Associates, Inc.

Appendix B – Photo Log

Buckroe Beach & Riley's Way Watershed Management Plan



Photograph Log Map

Photo 1
Photo 2
Photo 3
Photo 4
Photo 5
Photo 6
Photo 7
Photo 8

Legend

- Photo Station
- Project Area

0 750 1,500 3,000 Feet

1 inch = 1,500 feet

N W E S

Prepared for:

City of Hampton

Prepared by:

Kimley-Horn and Associates, Inc.

Kimley-Horn and Associates, Inc.	Project: Buckroe Beach Watershed Study	Prepared by: Rachel Watts
	Job Number: 116227084	Date: November 19, 2013
	Photo Event: Site Visit	Page: Page 1 of 4

Photo 1: View of flooding on N 5th Street facing north

Photo 2: View of Salt Ponds looking northwest

Photo 3: View of Wallace Creek facing south

Photo 4: View of flooding adjacent to Bonita Drive, facing west

Photo 5: View of a drainage ditch adjacent to Rogers Avenue, facing north

Photo 6: View of flooding in the parking lot of Buckroe Shopping Center, facing north

Kimley-Horn and Associates, Inc.	Project: Buckroe Beach Watershed Study	Prepared by: Rachel Watts
	Job Number: 116227084	Date: November 19, 2013
	Photo Event: Site Visit	Page: Page 4 of 4

Photo 7: View of a drainage ditch behind Buckroe Shopping Center, facing northeast

Photo 8: View of a drainage ditch behind Buckroe Shopping Center, facing west

Appendix C – OPCC

Stormwater Feature	Total Cost	Pounds of Pollutants Removed			Costs per Pound of Pollutants Removed		
		TP	TN	TSS	TP	TN	TSS
Merrimack Elementary Wetland	$239,000	15	43	3775	$15,923	$5,566	$63
Jones Magnet Middle School Bioretention	$418,000	21	164	4499	$20,232	$2,546	$93
Buckroe Shopping Mall Wetland	$769,000	45	127	11205	$17,262	$6,033	$69
Buckroe Shopping Mall Permeable Pavement	$288,000	14	122	897	$20,719	$2,353	$321
Buckroe Avenue Redevelopment Wetland	$229,000	12	36	3141	$18,335	$6,409	$73
Amherst Road Wetland	$596,000	38	109	9619	$15,586	$5,446	$62
Fields Drive Wetland	$138,000	7	19	1656	$20,941	$7,325	$83
Hall Road Wetland	$271,000	8	24	2072	$32,888	$11,498	$131
5th Street Drainage Improvements	$1,506,000	NA	NA	NA	NA	NA	NA

Notes:

1. This cost opinion is based solely upon the conceptual improvements presented in the Watershed Management Plan for the Buckroe Beach and Riley's Way watershed as prepared by Kimley-Horn and Associates, Inc.
2. This cost opinion does not include costs for land acquisition, off-site right-of-way, off-site easements, permitting, or design.
3. This cost opinion does not include wetland/stream mitigation fees, unforseen remediation of site contaminants, or any other similar local or state development fees.
4. Unit costs used in this cost opinion are representative of typical market costs for this area as of the date of this cost opinion, and do not account for inflationary cost escalation during the time period from the date of this cost opinion to the start of construction.
5. No geotechnical reports have been completed at this stage of the probable opinion of construction cost.
6. Construction phase inspection service costs are not included in this estimate.
7. Grading estimates are only conceptual and are based on existing GIS contours available for the study area. Estimates are not based on topographic survey by a licensed surveyor. This should be estimated during design.

The Engineer has no control over the cost of labor, materials, or equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs, as provided here, are made on the basis of the Engineer's experience and qualifications and represent the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from opinions of probable cost prepared for the Owner.

Merrimack Elementary Constructed Wetland Retrofit

Item	Unit	Quantity	Unit Cost	Total Cost
36" Reinforced Concrete Pipe, Installed	Linear Foot	90	$145	$13,050
Connection to Existing Structure, 15"-36" Pipe	Each	2	$765	$1,530
Riser Structure, Installed	Vertical Linear Foot	6	$400	$2,400
Excavation (Hauled Off-Site)	Cubic Yard	4,270	$15	$64,050
Import Topsoil (Assume 2" From Off-Site)	Cubic Yard	240	$15	$3,600
Wetland Planting	Square Yard	4,270	$10	$42,700
12" Rip Rap, Not Grouted	Square Yard	60	$44	$2,640
Clearing and Grubbing, Light	Acre	4	$6,650	$23,940
Construction Survey and Stake Out	Each	1	$8,000	$8,000
Erosion and Sediment Control	Each	1	$5,000	$5,000
Mobilization	Percent of Sub-Total	5	$1,670	$8,350
Design	Percent of Sub-Total	25	$1,670	$41,750
Sub-Total Construction Cost				$217,000
Contingency	Percent of Sub-Total	10	$2,170	$22,000
Total Construction Cost				$239,000

Jones Magnet Middle School Bioretention Retrofit

Item	Unit	Quantity	Unit Cost	Total Cost
18" Reinforced Concrete Pipe, Installed	Linear Foot	150	$67	$10,050
30" Reinforced Concrete Pipe, Installed	Linear Foot	110	$104	$11,440
Connection to Existing Structure, 15"-36" Pipe	Each	5	$763	$3,820
Manhole	Each	1	$492	$490
Riser Structure	Vertical Linear Foot	9	$400	$3,600
Underdrain	Linear Foot	1,500	$18	$27,000
Excavation	Cubic Yard	3,750	$15	$56,250
Engineered Soil Mixture	Cubic Yard	1,980	$50	$99,000
Bioretention Planting	Square Yard	7,500	$10	$75,000
12" Rip Rap, Not Grouted	Square Yard	150	$44	$6,600
Clearing and Grubbing, Light	Acre	2	$6,650	$9,980
Construction Survey and Stake Out	Each	1	$3,500	$3,500
Erosion and Sediment Control	Each	1	$2,500	$2,500
Mobilization	Percent of Sub-Total	5	$3,090	$15,450
Design	Percent of Sub-Total	25	$3,090	$77,250
Sub-Total Construction Cost				$380,000
Contingency	Percent of Sub-Total	10	$3,800	$38,000
Total Construction Cost				$418,000

Buckroe Shopping Mall Constructed Wetland Retrofit

Item	Unit	Quantity	Unit Cost	Total Cost
18" Reinforced Concrete Pipe, Installed	Linear Foot	160	$67	$10,720
36" Reinforced Concrete Pipe, Installed	Linear Foot	540	$145	$78,300
Connection to Existing Structure, 15"-36" Pipe	Each	3	$763	$2,290
Riser Structure, Installed	Vertical Linear Foot	6	$400	$2,400
Pipe Demolition, 15"-24" Pipe	Linear Foot	920	$50	$46,000
Excavation (Hauled Off-Site)	Cubic Yard	13,870	$15	$208,050
Import Topsoil (Assume 2" From Off-Site)	Cubic Yard	780	$15	$11,700
Wetland Planting	Square Yard	13,870	$10	$138,700
12" Rip Rap, Not Grouted	Square Yard	90	$44	$3,960
Clearing and Grubbing, Light	Acre	2.9	$6,650	$19,290
Construction Survey and Stake Out	Each	1	$10,000	$10,000
Erosion and Sediment Control	Each	1	$6,500	$6,500
Mobilization	Percent of Sub-Total	5	$5,380	$26,900
Design	Percent of Sub-Total	25	$5,380	$134,500
Sub-Total Construction Cost				$699,000
Contingency	Percent of Sub-Total	10	$6,990	$70,000
Total Construction Cost				$769,000

Buckroe Shopping Mall Permeable Pavement Retrofit

Item	Unit	Quantity	Unit Cost	Total Cost
Permeable Pavement Materials and Installation	Square Yard	29,100	$9	$261,900
Sub-Total Construction Cost				$261,900
Contingency	Percent of Sub-Total	10	$2,620	$26,000
Total Construction Cost				$288,000

Buckroe Avenue Redevelopment Constructed Wetland Retrofit

Item	Unit	Quantity	Unit Cost	Total Cost
24" Reinforced Concrete Pipe, Installed	Linear Foot	130	$87	$11,310
36" Reinforced Concrete Pipe, Installed	Linear Foot	190	$145	$27,550
Connection to Existing Structure, 15"-36" Pipe	Each	2	$763	$1,530
Riser Structure, Installed	Vertical Linear Foot	6	$400	$2,400
Excavation (Hauled Off-Site)	Cubic Yard	4,080	$15	$61,200
Import Topsoil (Assume 2" From Off-Site)	Cubic Yard	230	$15	$3,450
Wetland Planting	Square Yard	4,080	$10	$40,800
12" Rip Rap, Not Grouted	Square Yard	60	$44	$2,640
Clearing and Grubbing, Light	Acre	0.4	$6,650	$2,660
Construction Survey and Stake Out	Each	1	$4,000	$4,000
Erosion and Sediment Control	Each	1	$2,500	$2,500
Mobilization	Percent of Sub-Total	5	$1,600	$8,000
Design	Percent of Sub-Total	25	$1,600	$40,000
Sub-Total Construction Cost				$208,000
Contingency	Percent of Sub-Total	10	$2,080	$21,000
Total Construction Cost				$229,000

Amherst Road Constructed Wetland Retrofit

Item	Unit	Quantity	Unit Cost	Total Cost
24" Reinforced Concrete Pipe, Installed	Linear Foot	290	$67	$19,430
36" Reinforced Concrete Pipe, Installed	Linear Foot	440	$145	$63,800
Connection to Existing Structure, 15"-36" Pipe	Each	2	$763	$1,530
Riser Structure, Installed	Vertical Linear Foot	6	$400	$2,400
Pipe Demolition, 15"-24" Pipe	Linear Foot	270	$50	$13,500
Excavation (Hauled Off-Site)	Cubic Yard	10,800	$15	$162,000
Import Topsoil (Assume 2" From Off-Site)	Cubic Yard	600	$15	$9,000
Wetland Planting	Square Yard	10,800	$10	$108,000
12" Rip Rap, Not Grouted	Square Yard	30	$44	$1,320
Clearing and Grubbing, Light	Acre	2.2	$6,650	$14,840
Construction Survey and Stake Out	Each	1	$15,000	$15,000
Erosion and Sediment Control	Each	1	$6,500	$6,500
Mobilization	Percent of Sub-Total	5	$4,170	$20,850
Design	Percent of Sub-Total	25	$4,170	$104,250
Sub-Total Construction Cost				$542,000
Contingency	Percent of Sub-Total	10	$5,420	$54,000
Total Construction Cost				$596,000

Fields Drive Constructed Wetland Retrofit

Item	Unit	Quantity	Unit Cost	Total Cost
24" Reinforced Concrete Pipe, Installed	Linear Foot	170	$67	$11,390
Connection to Existing Structure, 15"-36" Pipe	Each	2	$763	$1,530
Riser Structure, Installed	Vertical Linear Foot	6	$400	$2,400
Excavation (Hauled Off-Site)	Cubic Yard	2,400	$15	$36,000
Import Topsoil (Assume 2" From Off-Site)	Cubic Yard	130	$15	$1,950
Wetland Planting	Square Yard	2,400	$10	$24,000
12" Rip Rap, Not Grouted	Square Yard	30	$44	$1,320
Clearing and Grubbing, Light	Acre	0.5	$6,650	$3,300
Construction Survey and Stake Out	Each	1	$8,000	$8,000
Erosion and Sediment Control	Each	1	$6,500	$6,500
Mobilization	Percent of Sub-Total	5	$960	$4,800
Design	Percent of Sub-Total	25	$960	$24,000
Sub-Total Construction Cost				$125,000
Contingency	Percent of Sub-Total	10	$1,250	$13,000
Total Construction Cost				$138,000

Hall Road Constructed Wetland Retrofit

Item	Unit	Quantity	Unit Cost	Total Cost
24" Reinforced Concrete Pipe, Installed	Linear Foot	290	$67	$19,430
36" Reinforced Concrete Pipe, Installed	Linear Foot	440	$145	$63,800
Connection to Existing Structure, 15"-36" Pipe	Each	2	$763	$1,530
Riser Structure, Installed	Vertical Linear Foot	6	$400	$2,400
Excavation (Hauled Off-Site)	Cubic Yard	3,100	$15	$46,500
Import Topsoil (Assume 2" From Off-Site)	Cubic Yard	170	$15	$2,550
Wetland Planting	Square Yard	3,100	$10	$31,000
12" Rip Rap, Not Grouted	Square Yard	30	$44	$1,320
Clearing and Grubbing, Light	Acre	1	$6,650	$4,260
Construction Survey and Stake Out	Each	1	$10,000	$10,000
Erosion and Sediment Control	Each	1	$6,500	$6,500
Mobilization	Percent of Sub-Total	5	$1,890	$9,450
Design	Percent of Sub-Total	25	$1,890	$47,250
Sub-Total Construction Cost				$246,000
Contingency	Percent of Sub-Total	10	$2,460	$25,000
Total Construction Cost				$271,000

5th Street Drainage Improvements

Item	Unit	Quantity	Unit Cost	Total Cost
Storm Surge Gate and Associated Infrastructure	Lump Sum	1	$500,000	$500,000
60" Reinforced Concrete Pipe, Installed	Linear Foot	150	$361	$54,150
8" Asphalt Baselayer	Ton	1,200	$80	$96,000
2" Asphalt Surface Layer	Ton	300	$102	$30,600
Guardrail	Linear Foot	1,200	$13	$15,600
Fill, Delivered	Cubic Yard	5,000	$15	$75,000
Tidal Wetlands Impact Mitigation	Acre	1	$527,000	$263,500
Construction Survey and Stake Out	Each	1	$12,000	$12,000
Erosion and Sediment Control	Each	1	$6,000	$6,000
Mobilization	Percent of Sub-Total	5	$10,530	$52,650
Design	Percent of Sub-Total	25	$10,530	$263,250
Sub-Total Construction Cost				$1,369,000
Contingency	Percent of Sub-Total	10	$13,690	$137,000
Total Construction Cost				$1,506,000

Appendix D – Nutrient Calculations

Virginia Runoff Reduction Method Worksheet -- Revised 03/25/2011

Site Data

Project Name: Merrimack Elementary School Bioretention Area

Date: November, 2013

	data input cells
	calculation cells
	constant values

1. Post-Development Project & Land Cover Information

Constants

Annual Rainfall (inches)	44				
Target Rainfall Event (inches)	1.00				
Phosphorus EMC (mg/L)	0.26		Nitrogen EMC (mg/L)	1.86	
Target Phosphorus Target Load (lb/acre/yr)	0.41				
Pj	0.90				

Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	4.70	4.70
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	9.27	9.27
Impervious Cover (acres)	0.00	0.00	0.00	11.24	11.24
				Total	25.21

Rv Coefficients

	A soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Land Cover Summary

Forest/Open Space Cover (acres)	4.70		
Weighted Rv(forest)	0.05		
% Forest	19%		
Managed Turf Cover (acres)	9.27		
Weighted Rv(turf)	0.25		
% Managed Turf	37%		
Impervious Cover (acres)	11.24		
Rv(impervious)	0.95		
% Impervious	45%		
Total Site Area (acres)	25.21		
Site Rv	0.52		
Post-Development Treatment Volume (acre-ft)	1.10		
Post-Development Treatment Volume (cubic feet)	48,027		
Post_Development Load (TP) (lb/yr)	30.59	Post_Development Load (TN) (lb/yr)	218.83
Total Load (TP) Reduction Required (lb/yr)	20.25		

Drainage Area - Merrimack Elementary School

Drainage Area A Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	4.70	4.70
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	9.27	9.27
Impervious Cover (acres)	0.00	0.00	0.00	11.24	11.24
				Total	25.21

Apply Practices that Remove Pollutants but Do Not Reduce Runoff Volume

Practice	Unit	Area (excluding areas treated by upstream practices)	Phosphorus Efficiency (%)	Runoff from Upstream RR Practices (cf)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed
12. Constructed Wetland									
2.a.Constructed Wetland #1 (Spec #13	impervious acres draining to wetland	11.24	50	0.00	0.00	24.66	12.33	12.33	
	turf acres draining to wetland	9.27	50	0.00	0.00	5.35	2.68	2.68	
2.b. Constructed Wetland #2 (Spec #13	impervious acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	
	turf acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	
						PHOSPHORUS REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A	15.01		
						TOTAL PHOSPHORUS REMOVAL IN D.A. A (lb/yr)	15.01		

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

						NITROGEN REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A	42.94		
						TOTAL NITROGEN REMOVAL IN D.A. A (lb/yr)	42.94		

Site Results				
Phosphorous				
TOTAL TREATMENT VOLUME (cf)	48,027			
TOTAL PHOSPHOROUS LOAD REDUCTION REQUIRED (LB/YEAR)	20.25			
RUNOFF REDUCTION (cf)	0			
PHOSPHOROUS LOAD REDUCTION ACHIEVED (LB/YR)	15.01			
ADJUSTED POST-DEVELOPMENT PHOSPHOROUS LOAD (TP) (lb/yr)	15.58			
REMAINING PHOSPHOROUS LOAD REDUCTION (LB/YR) NEEDED	5.25			
Nitrogen (for information purposes)				
TOTAL TREATMENT VOLUME (cf)	48,027			
RUNOFF REDUCTION (cf)	0			
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	42.94			
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TP) (lb/yr)	175.89			

Virginia Runoff Reduction Method Worksheet -- Revised 03/25/2011

Site Data

Project Name: Jones Magnet Middle School Bioretention Area

Date: November, 2013

	data input cells
	calculation cells
	constant values

1. Post-Development Project & Land Cover Information

Constants

Annual Rainfall (inches)	44				
Target Rainfall Event (inches)	1.00				
Phosphorus EMC (mg/L)	0.26		Nitrogen EMC (mg/L)	1.86	
Target Phosphorus Target Load (lb/acre/yr)	0.41				
Pj	0.90				

Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	7.99	7.99
Impervious Cover (acres)	0.00	0.00	0.00	8.36	8.36
				Total	16.35

Rv Coefficients

	A soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Land Cover Summary

Forest/Open Space Cover (acres)	0.00			
Weighted Rv(forest)	0.00			
% Forest	0%			
Managed Turf Cover (acres)	7.99			
Weighted Rv(turf)	0.25			
% Managed Turf	49%			
Impervious Cover (acres)	8.36			
Rv(impervious)	0.95			
% Impervious	51%			
Total Site Area (acres)	16.35			
Site Rv	0.61			
Post-Development Treatment Volume (acre-ft)	0.83			
Post-Development Treatment Volume (cubic feet)	36,080			
Post_Development Load (TP) (lb/yr)	22.98	Post_Development Load (TN) (lb/yr)		164.40
Total Load (TP) Reduction Required (lb/yr)	16.28			

Drainage Area - Jones Magnet Middle School

Drainage Area A Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	7.99	7.99
Impervious Cover (acres)	0.00	0.00	0.00	8.36	8.36
				Total	16.35

Apply Runoff Reduction Practices to Reduce Treatment Volume & Post-Development Load in Drainage Area A

Credit	Unit	Description of Credit	Credit	Credit Area (acres)	Volume from Upstream RR Practice (cf)	Runoff Reduction (cf)	Remaining Runoff Volume (cf)	Phosphorus Efficiency (%)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)
6. Bioretention												
6.a. Bioretention #1 or Urban Bioretention (Spec #9)	impervious acres draining to bioretention	40% runoff volume reduction	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00
	turf acres draining to bioretention	40% runoff volume reduction	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00
6.b. Bioretention #2 (Spec #9)	impervious acres draining to bioretention	80% runoff volume reduction	0.80	8.36	0	23064	5766	50	0.00	18.34	16.51	1.83
	turf acres draining to bioretention	80% runoff volume reduction	0.80	7.99	0	5801	1450	50	0.00	4.61	4.15	0.46
			TOTAL PHOSPHOROUS REMOVAL REQUIRED ON SITE (lb/yr)			16.28						
				TOTAL RUNOFF REDUCTION IN D.A. A (cf)		28,864						
					PHOSPHORUS REMOVAL FROM RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	20.66						

Site Results					
Phosphorous					
TOTAL TREATMENT VOLUME (cf)	36,080				
TOTAL PHOSPHOROUS LOAD REDUCTION REQUIRED (LB/YEAR)	16.28				
RUNOFF REDUCTION (cf)	28864				
PHOSPHOROUS LOAD REDUCTION ACHIEVED (LB/YR)	20.66				
ADJUSTED POST-DEVELOPMENT PHOSPHOROUS LOAD (TP) (lb/yr)	2.32				
REMAINING PHOSPHOROUS LOAD REDUCTION (LB/YR) NEEDED	CONGRATULATIONS!! YOU EXCEEDED THE TARGET REDUCTION BY 4.4 LB/YEAR!!				
Nitrogen (for information purposes)					
TOTAL TREATMENT VOLUME (cf)	36,080				
RUNOFF REDUCTION (cf)	28864				
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	151.07				
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TP) (lb/yr)	13.32				

Virginia Runoff Reduction Method Worksheet -- Revised 03/25/2011

Site Data

Project Name: Buckroe Shopping Mall Constructed Wetland Retrofit

Date: November, 2013

	data input cells
	calculation cells
	constant values

1. Post-Development Project & Land Cover Information

Constants

Annual Rainfall (inches)	44				
Target Rainfall Event (inches)	1.00				
Phosphorus EMC (mg/L)	0.26		Nitrogen EMC (mg/L)	1.86	
Target Phosphorus Target Load (lb/acre/yr)	0.41				
Pj	0.90				

Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	2.39	2.39
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	52.78	52.78
Impervious Cover (acres)	0.00	0.00	0.00	26.72	26.72
				Total	81.89

Rv Coefficients

	A soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Land Cover Summary

Forest/Open Space Cover (acres)	2.39		
Weighted Rv(forest)	0.05		
% Forest	3%		
Managed Turf Cover (acres)	52.78		
Weighted Rv(turf)	0.25		
% Managed Turf	64%		
Impervious Cover (acres)	26.72		
Rv(impervious)	0.95		
% Impervious	33%		
Total Site Area (acres)	81.89		
Site Rv	0.47		
Post-Development Treatment Volume (acre-ft)	3.22		
Post-Development Treatment Volume (cubic feet)	140,476		
Post_Development Load (TP) (lb/yr)	89.47	Post_Development Load (TN) (lb/yr)	640.07
Total Load (TP) Reduction Required (lb/yr)	55.90		

Drainage Area - Buckroe Shopping Mall

Drainage Area A Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	2.39	2.39
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	52.78	52.78
Impervious Cover (acres)	0.00	0.00	0.00	26.72	26.72
				Total	81.89

Apply Practices that Remove Pollutants but Do Not Reduce Runoff Volume

Practice	Unit	Area (excluding areas treated by upstream practices)	Phosphorus Efficiency (%)	Runoff from Upstream RR Practices (cf)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed
12. Constructed Wetland									
	impervious acres draining to wetland	26.72	50	0.00	0.00	58.62	29.31	29.31	
2.a.Constructed Wetland #1 (Spec #13	turf acres draining to wetland	52.78	50	0.00	0.00	30.47	15.24	15.24	
	impervious acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	
2.b. Constructed Wetland #2 (Spec #13	turf acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	

PHOSPHORUS REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A 44.55

TOTAL PHOSPHORUS REMOVAL IN D.A. A (lb/yr) 44.55

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

NITROGEN REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A 127.47

TOTAL NITROGEN REMOVAL IN D.A. A (lb/yr) 127.47

Site Results				
Phosphorous				
TOTAL TREATMENT VOLUME (cf)	140,476			
TOTAL PHOSPHOROUS LOAD REDUCTION REQUIRED (LB/YEAR)	55.90			
RUNOFF REDUCTION (cf)	0			
PHOSPHOROUS LOAD REDUCTION ACHIEVED (LB/YR)	44.55			
ADJUSTED POST-DEVELOPMENT PHOSPHOROUS LOAD (TP) (lb/yr)	44.92			
REMAINING PHOSPHOROUS LOAD REDUCTION (LB/YR) NEEDED	11.35			
Nitrogen (for information purposes)				
TOTAL TREATMENT VOLUME (cf)	140,476			
RUNOFF REDUCTION (cf)	0			
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	127.47			
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TP) (lb/yr)	512.59			

Virginia Runoff Reduction Method Worksheet -- Revised 03/25/2011

Site Data

Project Name: Buckroe Shopping Mall Permeable Pavement

Date: November, 2013

	data input cells
	calculation cells
	constant values

1. Post-Development Project & Land Cover Information

Constants

Annual Rainfall (inches)	44				
Target Rainfall Event (inches)	1.00				
Phosphorus EMC (mg/L)	0.26		Nitrogen EMC (mg/L)	1.86	
Target Phosphorus Target Load (lb/acre/yr)	0.41				
Pj	0.90				

Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.10	0.10
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	0.26	0.26
Impervious Cover (acres)	0.00	0.00	0.00	7.80	7.80
				Total	8.16

Rv Coefficients

	A soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Land Cover Summary

Forest/Open Space Cover (acres)	0.10		
Weighted Rv(forest)	0.05		
% Forest	1%		
Managed Turf Cover (acres)	0.26		
Weighted Rv(turf)	0.25		
% Managed Turf	3%		
Impervious Cover (acres)	7.80		
Rv(impervious)	0.95		
% Impervious	96%		
Total Site Area (acres)	8.16		
Site Rv	0.92		
Post-Development Treatment Volume (acre-ft)	0.62		
Post-Development Treatment Volume (cubic feet)	27,152		
Post_Development Load (TP) (lb/yr)	17.29	Post_Development Load (TN) (lb/yr)	123.72
Total Load (TP) Reduction Required (lb/yr)	13.95		

Drainage Area - Buckroe Shopping Mall Permeable Pavement

Drainage Area A Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.10	0.10
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	0.26	0.26
Impervious Cover (acres)	0.00	0.00	0.00	7.80	7.80
				Total	8.16

Apply Runoff Reduction Practices to Reduce Treatment Volume & Post-Development Load in Drainage Area A

Credit	Unit	Description of Credit	Credit	Credit Area (acres)	Volume from Upstream RR Practice (cf)	Runoff Reduction (cf)	Remaining Runoff Volume (cf)	Phosphorus Efficiency (%)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)
3. Permeable Pavement												
3.a. Permeable Pavement #1 (Spec #7	acres of permeable pavement + acres of "external" (upgradient) impervious pavement	45% runoff volume reduction	0.45	0.00	0	0	0	25	0.00	0.00	0.00	0.00
3.b. Permeable Pavement #2 (Spec #7	acres of permeable pavement	75% runoff volume reduction	0.75	7.80	0	20174	6725	25	0.00	17.11	13.90	3.21

TOTAL PHOSPHOROUS REMOVAL REQUIRED ON SITE (lb/yr)	13.95
TOTAL RUNOFF REDUCTION IN D.A. A (cf)	20,174
PHOSPHORUS REMOVAL FROM RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	13.90

Site Results				
Phosphorous				
TOTAL TREATMENT VOLUME (cf)	27,152			
TOTAL PHOSPHOROUS LOAD REDUCTION REQUIRED (LB/YEAR)	13.95			
RUNOFF REDUCTION (cf)	20174			
PHOSPHOROUS LOAD REDUCTION ACHIEVED (LB/YR)	13.90			
ADJUSTED POST-DEVELOPMENT PHOSPHOROUS LOAD (TP) (lb/yr)	3.39			
REMAINING PHOSPHOROUS LOAD REDUCTION (LB/YR) NEEDED	0.04			
Nitrogen (for information purposes)				
TOTAL TREATMENT VOLUME (cf)	27,152			
RUNOFF REDUCTION (cf)	20174			
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	99.47			
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TP) (lb/yr)	24.25			

Virginia Runoff Reduction Method Worksheet -- Revised 03/25/2011

Site Data

Project Name: Buckroe Avenue Redevelopment Constructed Wetland Retrofit

Date: November, 2013

	data input cells
	calculation cells
	constant values

1. Post-Development Project & Land Cover Information

Constants

Annual Rainfall (inches)	44				
Target Rainfall Event (inches)	1.00				
Phosphorus EMC (mg/L)	0.26		Nitrogen EMC (mg/L)	1.86	
Target Phosphorus Target Load (lb/acre/yr)	0.41				
Pj	0.90				

Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.49	0.49
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	16.54	16.54
Impervious Cover (acres)	0.00	0.00	0.00	7.03	7.03
				Total	24.06

Rv Coefficients

	A soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Land Cover Summary

Forest/Open Space Cover (acres)	0.49		
Weighted Rv(forest)	0.05		
% Forest	2%		
Managed Turf Cover (acres)	16.54		
Weighted Rv(turf)	0.25		
% Managed Turf	69%		
Impervious Cover (acres)	7.03		
Rv(impervious)	0.95		
% Impervious	29%		
Total Site Area (acres)	24.06		
Site Rv	0.45		
Post-Development Treatment Volume (acre-ft)	0.90		
Post-Development Treatment Volume (cubic feet)	39,342		
Post_Development Load (TP) (lb/yr)	25.06	Post_Development Load (TN) (lb/yr)	179.26
Total Load (TP) Reduction Required (lb/yr)	15.19		

Drainage Area - Buckroe Avenue Redevelopment

Drainage Area A Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.49	0.49
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	16.54	16.54
Impervious Cover (acres)	0.00	0.00	0.00	7.03	7.03
				Total	24.06

Apply Practices that Remove Pollutants but Do Not Reduce Runoff Volume

Practice	Unit	Area (excluding areas treated by upstream practices)	Phosphorus Efficiency (%)	Runoff from Upstream RR Practices (cf)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed
12. Constructed Wetland									
	impervious acres draining to wetland	7.03	50	0.00	0.00	15.42	7.71	7.71	
2.a.Constructed Wetland #1 (Spec #13	turf acres draining to wetland	16.54	50	0.00	0.00	9.55	4.77	4.77	
	impervious acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	
2.b. Constructed Wetland #2 (Spec #13	turf acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	

PHOSPHORUS REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A 12.49

TOTAL PHOSPHORUS REMOVAL IN D.A. A (lb/yr) 12.49

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

NITROGEN REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A 35.73

TOTAL NITROGEN REMOVAL IN D.A. A (lb/yr) 35.73

Site Results				
Phosphorous				
TOTAL TREATMENT VOLUME (cf)	39,342			
TOTAL PHOSPHOROUS LOAD REDUCTION REQUIRED (LB/YEAR)	15.19			
RUNOFF REDUCTION (cf)	0			
PHOSPHOROUS LOAD REDUCTION ACHIEVED (LB/YR)	12.49			
ADJUSTED POST-DEVELOPMENT PHOSPHOROUS LOAD (TP) (lb/yr)	12.57			
REMAINING PHOSPHOROUS LOAD REDUCTION (LB/YR) NEEDED	2.71			
Nitrogen (for information purposes)				
TOTAL TREATMENT VOLUME (cf)	39,342			
RUNOFF REDUCTION (cf)	0			
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	35.73			
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TP) (lb/yr)	143.53			

Virginia Runoff Reduction Method Worksheet -- Revised 03/25/2011

Site Data

Project Name: Amherst Road Constructed Wetland Retrofit

Date: November, 2013

	data input cells
	calculation cells
	constant values

1. Post-Development Project & Land Cover Information

Constants

Annual Rainfall (inches)	44				
Target Rainfall Event (inches)	1.00				
Phosphorus EMC (mg/L)	0.26		Nitrogen EMC (mg/L)	1.86	
Target Phosphorus Target Load (lb/acre/yr)	0.41				
Pj	0.90				

Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	2.83	2.83
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	35.08	35.08
Impervious Cover (acres)	0.00	0.00	0.00	25.63	25.63
				Total	63.54

Rv Coefficients

	A soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Land Cover Summary

Forest/Open Space Cover (acres)	2.83		
Weighted Rv(forest)	0.05		
% Forest	4%		
Managed Turf Cover (acres)	35.08		
Weighted Rv(turf)	0.25		
% Managed Turf	55%		
Impervious Cover (acres)	25.63		
Rv(impervious)	0.95		
% Impervious	40%		
Total Site Area (acres)	63.54		
Site Rv	0.52		
Post-Development Treatment Volume (acre-ft)	2.77		
Post-Development Treatment Volume (cubic feet)	120,734		
Post_Development Load (TP) (lb/yr)	76.90	Post_Development Load (TN) (lb/yr)	550.11
Total Load (TP) Reduction Required (lb/yr)	50.85		

Virginia Runoff Reduction Method Worksheet -- Revised 03/25/2011

Site Data

Project Name: Fields Drive Constructed Wetland Retrofit

Date: November, 2013

	data input cells
	calculation cells
	constant values

1. Post-Development Project & Land Cover Information

Constants

Annual Rainfall (inches)	44				
Target Rainfall Event (inches)	1.00				
Phosphorus EMC (mg/L)	0.26		Nitrogen EMC (mg/L)	1.86	
Target Phosphorus Target Load (lb/acre/yr)	0.41				
Pj	0.90				

Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	1.97	1.97
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	8.41	8.41
Impervious Cover (acres)	0.00	0.00	0.00	3.79	3.79
				Total	14.17

Rv Coefficients

	A soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Land Cover Summary

Forest/Open Space Cover (acres)	1.97		
Weighted Rv(forest)	0.05		
% Forest	14%		
Managed Turf Cover (acres)	8.41		
Weighted Rv(turf)	0.25		
% Managed Turf	59%		
Impervious Cover (acres)	3.79		
Rv(impervious)	0.95		
% Impervious	27%		
Total Site Area (acres)	14.17		
Site Rv	0.41		
Post-Development Treatment Volume (acre-ft)	0.48		
Post-Development Treatment Volume (cubic feet)	21,059		
Post_Development Load (TP) (lb/yr)	13.41	Post_Development Load (TN) (lb/yr)	95.96
Total Load (TP) Reduction Required (lb/yr)	7.60		

Drainage Area - Fields Drive

Drainage Area A Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	1.97	1.97
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	8.41	8.41
Impervious Cover (acres)	0.00	0.00	0.00	3.79	3.79
				Total	14.17

Apply Practices that Remove Pollutants but Do Not Reduce Runoff Volume

Practice	Unit	Area (excluding areas treated by upstream practices)	Phosphorus Efficiency (%)	Runoff from Upstream RR Practices (cf)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed
12. Constructed Wetland									
2.a.Constructed Wetland #1 (Spec #13	impervious acres draining to wetland	3.79	50	0.00	0.00	8.31	4.16	4.16	
	turf acres draining to wetland	8.41	50	0.00	0.00	4.86	2.43	2.43	
2.b. Constructed Wetland #2 (Spec #13	impervious acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	
	turf acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	
						PHOSPHORUS REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A	6.59		
						TOTAL PHOSPHORUS REMOVAL IN D.A. A (lb/yr)	6.59		

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

						NITROGEN REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A	18.84		
						TOTAL NITROGEN REMOVAL IN D.A. A (lb/yr)	18.84		

Site Results				
Phosphorous				
TOTAL TREATMENT VOLUME (cf)	21,059			
TOTAL PHOSPHOROUS LOAD REDUCTION REQUIRED (LB/YEAR)	7.60			
RUNOFF REDUCTION (cf)	0			
PHOSPHOROUS LOAD REDUCTION ACHIEVED (LB/YR)	6.59			
ADJUSTED POST-DEVELOPMENT PHOSPHOROUS LOAD (TP) (lb/yr)	6.83			
REMAINING PHOSPHOROUS LOAD REDUCTION (LB/YR) NEEDED	1.02			
Nitrogen (for information purposes)				
TOTAL TREATMENT VOLUME (cf)	21,059			
RUNOFF REDUCTION (cf)	0			
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	18.84			
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TP) (lb/yr)	77.11			

Virginia Runoff Reduction Method Worksheet -- Revised 03/25/2011

Site Data

Project Name: Hall Road Constructed Wetland Retrofit

Date: November, 2013

	data input cells
	calculation cells
	constant values

1. Post-Development Project & Land Cover Information

Constants

Annual Rainfall (inches)	44				
Target Rainfall Event (inches)	1.00				
Phosphorus EMC (mg/L)	0.26		Nitrogen EMC (mg/L)	1.86	
Target Phosphorus Target Load (lb/acre/yr)	0.41				
Pj	0.90				

Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	6.19	6.19
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	6.23	6.23
Impervious Cover (acres)	0.00	0.00	0.00	5.87	5.87
				Total	18.29

Rv Coefficients

	A soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Land Cover Summary

Forest/Open Space Cover (acres)	6.19		
Weighted Rv(forest)	0.05		
% Forest	34%		
Managed Turf Cover (acres)	6.23		
Weighted Rv(turf)	0.25		
% Managed Turf	34%		
Impervious Cover (acres)	5.87		
Rv(impervious)	0.95		
% Impervious	32%		
Total Site Area (acres)	18.29		
Site Rv	0.41		
Post-Development Treatment Volume (acre-ft)	0.62		
Post-Development Treatment Volume (cubic feet)	27,020		
Post_Development Load (TP) (lb/yr)	17.21	Post_Development Load (TN) (lb/yr)	123.11
Total Load (TP) Reduction Required (lb/yr)	9.71		

Drainage Area - Hall Road

Drainage Area A Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	6.19	6.19
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	6.23	6.23
Impervious Cover (acres)	0.00	0.00	0.00	5.87	5.87
				Total	18.29

Apply Practices that Remove Pollutants but Do Not Reduce Runoff Volume

Practice	Unit	Area (excluding areas treated by upstream practices)	Phosphorus Efficiency (%)	Runoff from Upstream RR Practices (cf)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed
12. Constructed Wetland									
2.a.Constructed Wetland #1 (Spec #13	impervious acres draining to wetland	5.87	50	0.00	0.00	12.88	6.44	6.44	
	turf acres draining to wetland	6.23	50	0.00	0.00	3.60	1.80	1.80	
2.b. Constructed Wetland #2 (Spec #13	impervious acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	
	turf acres draining to wetland	0.00	75	0.00	0.00	0.00	0.00	0.00	
					PHOSPHORUS REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A		8.24		
					TOTAL PHOSPHORUS REMOVAL IN D.A. A (lb/yr)		8.24		

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

					NITROGEN REMOVAL BY PRACTICES THAT DO NOT REDUCE RUNOFF VOLUME IN D.A. A		23.57		
					TOTAL NITROGEN REMOVAL IN D.A. A (lb/yr)		23.57		

Site Results				
Phosphorous				
TOTAL TREATMENT VOLUME (cf)	27,020			
TOTAL PHOSPHOROUS LOAD REDUCTION REQUIRED (LB/YEAR)	9.71			
RUNOFF REDUCTION (cf)	0			
PHOSPHOROUS LOAD REDUCTION ACHIEVED (LB/YR)	8.24			
ADJUSTED POST-DEVELOPMENT PHOSPHOROUS LOAD (TP) (lb/yr)	8.97			
REMAINING PHOSPHOROUS LOAD REDUCTION (LB/YR) NEEDED	1.47			
Nitrogen (for information purposes)				
TOTAL TREATMENT VOLUME (cf)	27,020			
RUNOFF REDUCTION (cf)	0			
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	23.57			
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TP) (lb/yr)	99.54			